

## HAZARD NAVIGATION LIGHT FOR WIND TURBINES

### BACKGROUND OF THE INVENTION

#### Field of the Invention

The invention concerns a wind power installation.

#### 5 Description of the Related Art

Wind power installations have long been known. They usually consist of a number of components such as a pylon and a machine housing which is mounted thereon and which accommodates the rotor of the wind power installation and the generator connected thereto for producing energy. Whenever 10 such wind power installations are located within air traffic zones, that is to say those regions which are directly in the relative proximity of airports, such wind power installations must be provided with certain signaling devices so that the attention of the air traffic is drawn to the existence of the wind power installation as a large structure, in good time.

15 Signaling devices can also be coats of paint on the rotor blades (in particular the tips thereof) of the wind power installation.

General guidelines for identifying obstacles to air travel are known from 'Nachrichten für Luftfahrer' ['News for Pilots'], Part I, NfL I 15/00, 27th January 2000.

20 The various flight lighting arrangements are also mentioned therein. Another flight lighting arrangement is known from DE-U-200 08 289.

### BRIEF SUMMARY OF THE INVENTION

In one aspect, embodiments of the invention reduce disadvantages of flight lighting arrangements.

In the wind power installation having one embodiment of a flight lighting arrangement is a flashing signaling device with a cover which prevents the flashing signaling device from being visible in a given cone (viewed from the flight lighting arrangement) laterally of the wind power installation as seen from the ground. The opposing sides of the cone can be separated by an angle of at least 45°, preferably 90° - 150°, or even equal or greater than 180° (horizontal). Such a cover prevents a view of the flight lighting arrangement when the flight lighting arrangement is viewed from within a region defined by the cone around the wind power installation, but normal air traffic may still recognize the light of the flight lighting arrangement from a distance.

In one embodiment, the cover is a mirrored surface with a parabolic configuration that causes the flashing signal to appear in strengthened form and more easily visible to the air traffic.

In another aspect, an embodiment provides an advantage in that the flight lighting arrangement can substantially reduce the light pollution for a residential population in the region around the wind power installation.

Depending on the respective height of the flight lighting arrangement, an angle of 150° or more can mean that, as viewed from the ground, the light from the flight lighting arrangement is not seen at a distance of 0 to 2000 m, preferably at least up to 1000 m, from the region around wind power installation. This means that the light from the flight lighting arrangement may no longer be a burden in adjoining or nearby residential areas.

The invention is described in greater detail hereinafter by means of several embodiment.

## 25 BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

Figure 1 shows a plan view of a wind power installation according to one embodiment of the invention,

Figure 2 shows a side view of a wind power installation according to one embodiment of the invention, and

Figures 3a, b, c, d and e show various embodiments of a wind power installation according to the invention.

## 5 DETAILED DESCRIPTION OF THE INVENTION

Figure 1 shows a plan view of a wind power installation 1 comprising a pylon and a machine housing 2 mounted thereon as well as the rotor 3 of the wind power installation and the machine housing casing (pod) 4. As can be seen in Figure 2 provided on the pod is a flight lighting arrangement 5 which is caused 10 to flash from time to time or constantly by a suitable control (not shown). Provided below the flight lighting arrangement is a cover 6 which prevents the light of the flight lighting arrangement from being visible from the ground in a region around the wind power installation. That region can be defined by a cone diameter of, for example 2000 m, as formed on the ground around the wind power installation. In 15 one embodiment, the light from the flight lighting arrangement cannot be seen in a region of up to about 1000 m around the wind power installation. The region around the wind power installation from which light from the flight lighting arrangement 5 is substantially blocked may vary based upon the height of the wind power installation, the shape and size of the cover 6 and/or pod 4, and the ambient 20 light conditions at the time of viewing. The volume from which light from the lighting arrangement may not be visible, as discussed herein, may be more accurately described as a cone frustum in which the top portion of the cone is truncated (*i.e.*, the light emitted from the flight lighting arrangement above the cover 6 is visible in the apex region of the cone and at a distance therefrom as 25 illustrated in Figure 3b).

The shape of the region may correspond to a shape of the cover 6 or pod 4. For example, if the cover 6 comprises a large circular disc, then the light of the flight lighting arrangements 5 would not be visible in a conical region below the

disc. Depending on the respective diameter of the disc, the covered (e.g., non-lit region) area can be larger (increase in the cone angle, as defined by an apex of the cone above the cover and illustrated in Figures 2 and 3b). If the cover 6 of the flight lighting arrangement 5 is parabolic in shape (Figure 3a) or box-shaped

- 5 (Figure 3c), the cone angle can be up to 180°. A cone angle of 180° or greater may prevent the flight lighting arrangement 5 or light therefrom from being viewable from the ground. Thus, when the cone angle is less than 180°, the light from the flight lighting arrangement 5 is practically no longer visible below the slanted lines defining the sides of the cone (see Figures 2 and 3), with respect to
- 10 the flight lighting arrangement 5. Large angles, as described, are usually unnecessary as the flight lighting arrangements 5 of the wind power installations are often located relatively high with respect to the surrounding buildings.

If the cone angle is about 160 to 170°, then the light of the flight lighting arrangement 5 may not be visible in a region of about 500 - 2000 m

- 15 laterally of the wind power installation, but may be visible by the flight traffic.

In principle, it is possible for the cover 6 of the flight lighting arrangement 5 to be such that it is always only the same region in a given lateral region of the wind power installation that is covered. If that cover 6 is stationary or can be adjusted by motor means (upon rotation of the pod about the point of

- 20 rotation), therefore, in such an embodiment, only the selected region laterally of the wind power installation that is covered, independently of an azimuth angle of the wind power installation. As Figures 3a - 3d show, various configurations of the cover 6 can be envisaged. In that respect it is the position of the outer edge 7 of the cover 6 that determines the coverage area (i.e., cone diameter).

- 25 The higher or more extended that outer edge 7 is taken, the correspondingly greater is the cone angle and the correspondingly greater is the cone diameter of the region around the wind power installation.

The intensity of the light from the flight lighting arrangement decreases with the distance from the wind power installation, thus it may be

sufficient if the cover provides a 'shadow range' of about 1500 to 3000 m, or markedly less, around the wind power installation.

All of the above U.S. patents, U.S. patent application publications, U.S. patent applications, foreign patents, foreign patent applications and non-patent publications referred to in this specification and/or listed in the Application Data Sheet, are incorporated herein by reference, in their entirety.

From the foregoing it will be appreciated that, although specific embodiments of the invention have been described herein for purposes of illustration, various modifications may be made without deviating from the spirit and scope of the invention. Accordingly, the invention is not limited except as by the appended claims.